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# Microbial Contamination of Water Storage Tanks

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Water Protection Program fact sheet

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## The Problem

Data collected on boil order incidents indicate elevated and ground storage tanks may be a major source of contamination in the distribution system of public water systems. Apparently, 25 percent or more of these tanks may be contaminated, commonly by birds or insects.

Typical defects that allow contamination are damaged or missing screens, holes cut in the top of the tanks, poorly constructed access openings, open or unlocked access lids and construction practices in some tanks more than 30 years old.

## Recommended Actions

The solution appears to be improved inspection and maintenance on a routine schedule.

Public water systems should:

- Inspect or have inspected water storage tanks at least every five years; require a written report of the inspection.
- Insist the inspection address screens, holes, access openings, radio antennas and cathodic protection installations in addition to the usual items.
- Use a reliable inspector or an engineering firm knowledgeable in the sanitary aspects of tanks. There is currently no certification of such inspectors.
- Sample the tank water semiannually for total coliform and fecal coliform bacteria. Consider also a heterotrophic plate count (HPC) analysis in addition to the coliform analyses.

Additional items to check-each tank must

- Have operational valves to isolate the tank from the distribution system;
- Have a drain valve and piping of adequate size to drain the tank within a reasonable time;
- Have a sampling tap to allow sampling of the tank bulk water while the tank is isolated from the rest of the distribution system;
- Have locking hatches, security ladders and security fences for protection from vandalism and terrorism.

## Inspection Frequency

A number of tanks have not been inspected for many years - some for 20 years or more. We recommend such tanks be inspected and a written report obtained within the next year. It appears the old riveted tanks (usually with lattice legs) constructed before the mid-50s are particularly prone to having sanitary defects in the hatch, vent, overflow and joint between the wall and roof overhang. Therefore, these tanks are high priority for immediate inspection. All tanks should be inspected at least every five years. The sanitary integrity of the tanks should be inspected at least annually.

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## Inspection Criteria

Previous inspection standards did not cover the sanitary integrity of water storage tanks, and were therefore inadequate. The current Steel Water-Storage Tanks manual of practices published by the American Water Works Association contains recommendations on inspecting the sanitary conditions of tanks. The water supplier should insist on sanitary features of the inspection to prevent the entrance of birds, insects and other vermin.

## Tank Inspectors

It is important that the inspector be competent and trained in identifying sanitary defects. The Department of Natural Resources and a mid-Missouri tank inspector have documented instances of tank inspectors or tank painting contractors overlooking obvious sanitary defects and missing screens. We have documented instances of them creating sanitary defects by cutting holes in the top of tanks to hang their internal rigging and leaving the hole open or covering it with duct tape. Competent inspectors may be few in number, but careful selection of inspectors is essential to assure the sanitary integrity of the various components of the water system.

**A satisfactory bacteriological sample for coliform bacteria is not necessarily adequate proof the tank is of good sanitary integrity.** Chlorine may mask the contamination and some defects only allow contamination after rainfalls or winds. Only an inspection by a competent party will suffice. We recommend you keep a written report of the inspection in your files.

## Extra Sampling Advised

When a coliform-positive sample occurs during routine distribution monitoring, follow-up samples should be taken from nearby water storage tanks and from wells or points of entry unless there is already an identifiable cause of the bad sample. This will help to quickly determine if the tank is contaminated through some breach of the sanitary integrity of the tank.

You should have the flexibility to isolate the tank from the system for draining and sampling. If not, for small systems, a sample can usually be obtained from an elevated storage tank by shutting down all wells or entry points into the water system for at least one hour and then collecting a sample within one block of the tank(s). You can use one of your regular routine samples, submit extra routine samples or submit a special sample. You should revise your sampling site plan to include a sampling tap within one block of the tank.

## Background

The chief executive officer of a major tank industry company reports that, of the tanks his company inspects, 25 percent have evidence of contamination and 85 percent have some type of sanitary defect.

The president of a local tank inspection company reports that, of the tanks his company inspects, 50 percent have serious sanitary defects with contamination evident in a majority of them and another 30 to 40 percent have minor sanitary defects.

From January 1991 through May 1994, birds or bird droppings in elevated tanks have accounted for 18 of 51 (35.4 percent) boil water orders in city and water district water supplies. It is the largest identifiable cause of boil water orders in water systems having storage tanks.

### **Cause of 51 Boil Water Orders**

Birds	18
Repairs	8
C1 Failures	6
X-Connection	2*
Unknown	13
Other	4

\*A cross-connection  
was a possibility on two other boil orders

### **Method of Entry of Birds**

Screen/Vents	7
Hole(s)	2
Hatch	4
Unknown	7

In addition, the department is aware of another 15 incidents where chlorine may have covered up the contamination or where insects caused only a total coliform Maximum Contaminant Level (MCL) violation instead of an acute fecal coliform MCL violation.

### **The finding of 33 contaminated tanks in 41 months is a rate of one tank every five weeks!**

According to the Centers for Disease Control, one of those tanks resulted in a Salmonella outbreak that led to approximately 500 illnesses and five deaths in a community during November and December 1993.

The above data indicate a major place for a breach in the sanitary integrity of the water supply is the elevated or ground storage tank. The contamination is occurring because of a lack of attention to the sanitary integrity of the water tanks. Sanitary inspections have been nonexistent on many tanks and inadequate on many others.

### **For more information**

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